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<p>(21) International Application Number: PCT/GB98/01566</p> <p>(22) International Filing Date: 12 June 1998 (12.06.98)</p> <p>(30) Priority Data: 9712377.2 14 June 1997 (14.06.97) GB</p> <p>(71)(72) Applicant and Inventor: GILES, Christopher, Edward [GB/GB]; Orchard Barn, Clarkes Lane, Ilketshall St. Andrew, Beccles, Suffolk NR34 8HR (GB).</p> <p>(74) Agents: COPP, David, Christopher et al.; Dummett Copp, 25 The Square, Martlesham Heath, Ipswich, Suffolk IP5 3SL (GB).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b>  <i>With international search report.  Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	
<p>(54) Title: FIRE HOSE SUPPORT</p> <p>(57) Abstract</p> <p>The present invention relates to a fire hose support (1) for holding a fire hose nozzle, in particular a fire hose support that may be temporarily clamped to hand railing (2, 3). The fire hose support comprises an elongate member (7, 9) with a pair of grips (4, 5) adapted to receive a pair of parallel handrails (2, 3) one in each grip (4, 5), the length of the elongate member (7, 9) being adjustable to adjust the distance between the grips (4, 5). Clamping means (22, 30) is provided to clamp at least one of the grips (4) to a handrail (2), and mounting means (88) is provided to releasably secure a fire hose nozzle to the support (1). The support (1) may be releasably secured to the pair of handrails (2, 3) by first opening a grip (4, 22) and adjusting the length of the elongate member (7, 9) until both handrails (2, 3) are received in the grips (4, 5) and then by clamping at least one of the grips (4) to engage both rails (2, 3) securely within the grips (4, 5).</p>			

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### Fire Hose Support

The present invention relates to a fire hose support, in particular a fire hose support that may be temporarily  
5 clamped to hand railing.

Fire hoses are an essential part of the fire-fighting safety equipment on oil drilling rig ships and production platforms. Fire hoses are also used for cooling purposes,  
10 in which a jet of water from a fire hose nozzle, which may be either narrowly directed or diffuse, is sprayed to cool down part of the platform or rig.

For example, a flare boom may be used to burn off unwanted  
15 gaseous or liquid hydrocarbons. The flare boom will generally have a water cooling circuit near its end to prevent the boom itself from overheating. If this cooling circuit fails, the boom can be temporarily cooled by an external jet of water from a fire hose.

20 Although there are normally two booms so one downwind may be used, changeable or gusting winds can sometimes blow the flame from the boom back towards part of the rig or platform. It may then be necessary to spray water against  
25 a part of the rig or platform, for example a wall or item of equipment, either to cool or to prevent that part from becoming too hot.

In the North Sea, it is customary for such fire hoses to  
30 be tied to a side railing, by wrapping several lashes of rope around the hose and railing. A second rope may then be needed to pull the nozzle and aim the jet of water in the correct direction.

35 Whilst such a system can be effective in directing a jet of water, it is inconvenient and time consuming to have

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to manually secure and aim a fire hose by roping it to a railing each time it is necessary to set up a cooling jet of water. Fire hoses secured in such a manner have also been noted to creep, so changing the direction of the 5 water spray, and posing a potential safety hazard.

- One way of solving this problem is to have fire hose pedestals bolted to the deck of a rig or platform at points where the need for cooling water may be expected.
- 10 A fire hose nozzle may be conveniently held and directed by a pedestal, however, such pedestals are relatively expensive and may not be easily set up or re-sited if cooling needs have not been correctly anticipated.
- 15 It is an object of the present invention to provide a more convenient way of securing and aiming a fire hose.

Accordingly, the invention provides a fire hose support for holding a fire hose nozzle, comprising an elongate 20 member with a pair of grips adapted to receive a pair of parallel handrails one in each grip, the length of the elongate member being adjustable to adjust the distance between the grips, clamping means to clamp at least one of the grips to a handrail, and mounting means to 25 releasably secure a fire hose nozzle to the support, in which the support may be releasably secured to a pair of handrails by first opening a grip and adjusting the length of the elongate member until both handrails are received in the grips and then clamping at least one of the grips 30 to engage both handrails securely within the grips.

Preferably, each grip is a bracket with a concave shaped entrance extending substantially transverse to the elongate member. The elongate member then extends 35 substantially transverse to the parallel rails when the fire hose support is engaged with the rails.

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- The clamping means may be any suitable means which acts to clamp a rail with a grip. The clamping means may comprise a plate, abutment, flange or other such feature
- 5      which opposes the entrance to one of the concave shaped brackets. The flange may then be slid able and securable with respect to the elongate member so that a grip may be clamped about a handrail.
- 10     In a preferred embodiment of the invention, the grips are arranged with concave shaped entrances facing in the same direction. Both grips of the fire hose support may then be brought to bear on the parallel hand rails in the same movement. If the spacing between grips is such that just
- 15     one grip engages with a rail, then the length of the elongate member may be adjusted so that both grips come into contact with the rails.
- 20     Alternatively, if the entrances to the grips face in opposite directions, then there may be no need for any separate clamping means, and the clamping may be effected by bringing both grips into engagement with the pair of rails, the pair of rails thereby being clamped between the inwardly facing entrances to the grips.
- 25     One of the grips may be fixed on the elongate member relative to the mounting means, with the other of the grips is movable on the elongate member relative to the mounting means. The clamping means may then be arranged
- 30     to clamp the grip fixed on the elongate member relative to the mounting means. The advantage of this arrangement is that the clamping means then may be movable relative to an otherwise inextensible or fixed portion only of the elongate member. The length adjustment may therefore be
- 35     independent of the adjustment of a gap between the flange and the entrance to the grip.

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Handrails are most commonly horizontal or sloping, for example along a staircase. Therefore, in general it will be convenient for the support to be removably affixed to  
5 a handrail with the nozzle in an uppermost part of the support. The mounting means may then advantageously be affixed to an end of the elongate member. Any fire hose or nozzle affixed to the mounting means may then be operated clear of any hindrance of the elongate member,  
10 grips, or hand rails.

In a preferred embodiment of the invention, the elongate member comprises a hollow sleeve from inside of which an inner member is relatively extensible and retractable to  
15 adjust the length of the elongate member. The inner member is therefore telescopically extensible, although in general it will only be necessary to have one telescopic stage, so that there need not be another extensible member nested inside the inner member.

20 If the sleeve has a slot therethrough, the elongate member may have securing means thereon to secure the length of the elongate member in the following manner. The securing means, which may be a commercially available so-called  
25 "toggle clamp", may be arranged so that it bears down through the slot upon the inner member to press the inner member against the inside of the sleeve. The length of the elongate member may then secured by virtue of the contact friction between the surfaces of the inner and elongate  
30 members.

35 Preferably the securing means is slid able in unison with the clamping means on the elongate member, the clamping means being clamped when the securing means secures the length of the elongate member. The clamping means and securing means may therefore comprise a sleeve which is

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slidable over a certain length of the elongate member.

The inner member may have a cross-section of the "box-within-box" type. However, in order to economise on  
5 material and to reduce weight, it is preferable if the inner member is L-shaped and the sleeve has an internal rectangular (which term includes herein the term "square") cross-section.

10 The mounting means will generally comprise a universal joint for the fire hose nozzle, the joint having means to fix the orientation of the joint, so that the direction of the nozzle may be set in substantially any direction.

15 In a preferred embodiment of the invention, the fire hose support comprises additionally a fire hose adapter which may be connected in-line between a fire hose and nozzle. The mounting means may then have a tongue which projects from the mounting means, and the adapter may have a  
20 corresponding channel for receiving the tongue, the arrangement being such that the back pressure from water sprayed by the nozzle serves to keep the tongue engaged within the channel. The advantage of the tongue and channel arrangement is that the adapter may very rapidly  
25 be removed or placed on the tongue, as may be necessary, for example, in an emergency or if a fire hose is needed urgently for some other purpose.

30 The shape of the tongue and channel may then be such that the tongue may only be inserted into the channel in one direction. For example, the tongue and channel may be rectangular cross-sections. One of the corner edges of the tongue may then be chamfered, with the internal cross-section of the channel being similarly shaped so that the  
35 channel and tongue may only be brought together in one orientation. In this manner, the possibility of the

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channel and tongue being brought together in a different orientation may be precluded, so avoiding the possibility that a fire hose may be mounted on the mounting means in an orientation which would result in the hose being pushed  
5 off the tongue owing to the back pressure of sprayed water.

If necessary, the tongue and/or the adapter may have locking means, such as a latch or holes for a padlock,  
10 which may be engaged to lock the adapter and tongue together.

The invention will now be further described by way of example with reference to the accompanying drawings, in  
15 which:

Figure 1 is a front view of a fire hose support according to the invention, shown secured to a pair of parallel handrails;

20 Figure 2 is a side view of the fire hose support of Figure 1; and

25 Figure 3 is an enlarged fragmentary view of the mounting means part of the fire hose support, showing the side opposite to that of Figure 2, with an adapter for a fire hose and nozzle.

Referring first to Figures 1 and 2, a fire hose support  
30 1, has been removably secured to a pair of horizontal and parallel tubular handrails 2,3. The structural elements of the support may be made from mild steel, suitably treated or painted for corrosion resistance, or from a corrosion resistant material such as stainless steel.  
35 Certain parts, for example bolts, may be made from brass.

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The support has a pair of similar elongate grips 4,5 with concave or V-shaped entrances thereto which are engaged with the handrails 2,3 to secure the support 1 in place. Each of the V-shaped grips is about 210 mm long, with each 5 of the sections or arms of each grip being about 50 mm wide. Such a grip may accommodate, typically, a rail with a diameter from about 25 mm to about 110 mm.

10 The fire hose support 1 is illustrated upright in the drawings, with a mounting means 10 for a fire hose and nozzle (not shown) at the top of the support. The entrances to the grips 4,5 will normally be downward facing, as drawn, but the fire hose support could be used inverted with the entrances to the grips 4,5 facing 15 upwards.

20 The entrances of grips 4,5 are mounted facing in the same direction on an elongate member which comprises an outer member in the form of a tubular rod 7, and an inner member or rod 9 of L-shaped cross-section slidable within the outer tubular rod, as indicated by the arrow labelled with the numeral 11. The upper grip 4 is on a median portion of the outer tubular rod 7 and is relatively fixed with respect to the mounting means 10, and the lower grip 5 is 25 at an end of the inner rod 9 and relatively movable with respect to the mounting means 10.

30 As shown in phantom, when the inner rod 9a is extended, the grips 4,5a may engage with handrails 2,3a having a greater separation. The spacing between grips may be varied between about 200 mm to about 450 mm.

35 The upper grip may be clamped to the handrail 2 by means of a clamping member comprising an elongate bracket 20 of L-shaped cross-section. One side 22 of the bracket extends parallel to the entrance to the upper grip 4, and the

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other side of the bracket parallel to the elongate member tubular rod 7.

5 The bracket 20 is movable up and down on the elongate member, as indicated by the arrow 24, and when brought upwards and secured against the underside of the rail 2, clamps the upper grip 4 on the rail 2.

10 The bracket rides on a sleeve 26, which extends around the tubular rod 7, but not interfering with the upper grip 4 as the bracket 20 is slid on the tubular rod 7.

15 The tubular rod 7 has a slot 28 cut through along one side thereof. A securing means, in the form of a toggle clamp 30, is connected to the sleeve 26. This has a handle 32 which when operated between two positions as indicated by the arrow 34, inserts and partially withdraws a plunger 36 in the slot 28. The plunger is locked in the inserted position by the action of the toggle clamp's lever 20 mechanism. Such a toggle clamp is commercially available as part number GH226/D from Garryson-Insley Ltd of Leicester, England.

25 In the released position, the plunger 36 still remains within the slot 28, and this keeps the sleeve 26 constrained to move between bounds defined by the end of the slot 28.

30 The plunger 36 has a rubber head 38, which comes into contact with and applies a pressure to one face of the L-shaped cross-section inner rod 9. Since the toggle clamp 30 is connected to the sleeve 26, the sleeve exerts a restoring force against the tubular rod 7, which is transmitted to the face of the inner rod 9 opposite the 35 face in contact with the rubber head 38, so compressing and pinching the inner and tubular rods together at this

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point. The pressure is sufficient to result in friction that, in most circumstances, effectively secures at the same time both the extension of the inner and tubular rods 7,9, and the sleeve, and hence clamping bracket 20. Both  
5 the extension of the elongate member 7,8 and the clamping of one of the grips 4 may therefore be secured in one action with the toggle clamp 30.

The toggle clamp 30 relies on the static friction  
10 generated by the pressure applied through the plunger rubber end 38. In some cases, the friction between the rubber end 38 and the inner rod 9 may be greater than the friction between sleeve 26 and the tubular rod 7, or between the tubular rod 7 and inner rod 9. Therefore, in  
15 extreme situations, it may be the case that the sleeve 26 could slip relative to the tubular rod 7. The illustrated embodiment therefore includes a bolt 40 which passes through a threaded bore in the sleeve and which may be finger tightened to bear down on an outer surface 42 of  
20 the tubular rod 7 opposite the slot 28 and nearly opposing the plunger 36.

The fire hose support may be removed from the railings by reversing the above steps.

25 Referring now also to Figure 3, the mounting means 10 comprises a pivot plate 50 pivotable in a direction indicated by an arrow labelled 51. The pivot plate 50 has annular slot 52 through which a threaded bolt 54 passes.  
30 One end of the bolt 54 is fixed to a washer 56 which overhangs the edges of the slot 52; the other end of the bolt is threaded into a matching sleeve (not shown) inside a circular knob 58, which may be rotated, as indicated by the arrow 60 in order to tighten or loosen the bolt 54. When  
35 the bolt 54 is tightened, the washer 56 pinches the pivot plate between the washer and a post 62 which is an offset

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extension of the tubular rod 9. This pinching action locks the pivot plate in position.

The post 62 is offset from the tubular rod 9 so that the  
5 top end 63, 63a of the inner L-shaped rod 7 may travel as far upwards as the underside of the mounting means 10 when the grips 4, 5 are brought together at the minimum spacing. This arrangement helps to reduce the overall length of the elongate member 7, 9 and the fire hose support 1.

10

The annular slot 52 extends about  $\pm 45^\circ$  of a central position. It has been found that in most situations this provides a sufficient degree of freedom of adjustment of a fire hose nozzle in one plane.

15

The pivot plate 50 wraps over the top of the post 62 to form a U-shaped bracket 63 which pivots about a pivot axis 64 through the U-shaped bracket 63 and the top end of the post 62. The pivot axis 64 comprises a threaded rod 68 retained at one end by a bolt 70, over which an end of the rod is peened, and at the other end by a bracket 72 welded to the pivot plate 50 and which has a bore to receive an extension 74 of the threaded rod 68 of reduced diameter.

20

25 The bracket has a narrow slot 76 cut partially therethrough which terminates in a plain bore 78 having an axis parallel to the axis of the pivot plate 50 defining a central, or  $0^\circ$ , angular adjustment of the pivot plate.

30

35 The reduced diameter section 74 of rod 68 passes through the slot and is engaged at the other end of the rod by the inside of a threaded sleeve 78 which may be turned by a handle 80 in a direction as shown by an arrow labelled with the numeral 82. The action of tightening the

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engagement between the sleeve 78 and the reduced section threaded rod 74 pulls a face of the handle 80 to bear on the end of the bracket 72, and this squeezes the narrow slot 76 and plain bore 78.

5

A pin 82 seated in the plain bore 78 may thereby squeezed and held in place. This pin defines a second degree of rotational freedom about a full  $360^\circ$  of the mounting means 10, as shown by the arrow indicated with the numeral 83.

10 Atop the pin 82 is a top plate 84 welded perpendicular to the pin, and which rests on a top surface 86 of the U-shaped bracket 63. From one edge of the top plate 84 a tongue 88, of generally rectangular cross-section, extends at an acute angle, here about  $45^\circ$ , to the top plate.

15

Figure 3 also shows an adapter 100, made from  $2\frac{1}{2}$ " (63.5 mm) diameter steel pipe 102 about 150 mm to 200 mm long with threaded ends 104,105 onto which are threaded standard receptacles 106,107 for, respectively, a fire hose nozzle and a flexible hose coupling (neither of which are illustrated).

On one side of a central portion of the steel pipe 102 is welded a generally rectangular outline coupling 108 with  
25 a channel 110 therethrough of generally rectangular cross-section adapted to receive the tongue 88, as indicated by the arrows 111. The channel 110 is cut at an angle equal to that of the tongue with respect to the top plate 84, so that when the tongue 88 is seated inside the channel  
30 110, the axis of the pipe 102 is parallel to the steel plate. This permits the adapter 100 to be seated closer to the top plate 84, and hence closer to the two pivot axes 64,78, and so helps to reduce the torque on these axes due to back pressure from water ejected through the  
35 nozzle.

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The direction of water flow through the adapter 100 is indicated by the arrow 112. Back pressure will be in the opposite direction and so will tend to push the adapter 5 more securely onto the tongue 88, owing to the angle of the channel 110 relative to the direction of water flow 112.

If the angle of the channel 110 relative to water flow 112 10 were in the opposite sense, then of course the backpressure would tend to unseat the adapter 100. Therefore, in order to ensure that the tongue 88 and adapter 100 may only be connected in one direction, the tongue has a chamfered edge 114 and the inside of the 15 channel a matching chamfered corner 116.

Either before or after mounting of the adapter 100 with fire hose and nozzle on the mounting means 10, the circular knob 58 and handle 80 may be loosened and the 20 angle of the adapter adjusted within the two rotational degrees of freedom in adjusting the direction of a fire hose nozzle (not shown).

There are, of course, several different national standards 25 in different countries for fire fighting equipment and types of couplings. For example bayonet fittings are standard for a Continental European nozzle and screw fittings for an American nozzle.

30 In use, the adapter 100 could remain attached to the tongue 88 even when the nozzle and hose were removed from the fire hose support.

Although not illustrated, it may be desirable to provide 35 a latch or other type of latching or locking mechanism so that once the adapter was attached to the tongue, the

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adapter could not be released without an operation first to disengage the latch or lock. One way of locking the adapter in place would be to make the tongue longer than illustrated, so that it protruded clear of the channel  
5 110, and then to provide a hole near the end of the tongue through which a pad lock could be locked. One way of latching would be to provide a spring biased latch or clip near the end of the tongue which after insertion through the channel 110, sprung outwards to latch over the end of  
10 the channel.

The fire hose support described above is relatively simple to affix to a pair of parallel railings, and may readily be moved to a new location if so desired. A standard fire  
15 hose nozzle may be quickly secured with the adapter 100, and a nozzle directed at an area needing a cooling jet of water. If the aim needs to be adjusted, this may readily be done without having to move the support or to disengage the nozzle from the adapter.

20 Such a fire hose support may be set up and aimed and left in place for an extended time, whether or not cooling water is always being supplied by a fire hose. As long as the support is sufficiently tightened to railing, the  
25 support will not creep or come loose, so addressing the safety issues of nozzles changing direction or coming completely loose and being lashed about by the force of the water escaping the nozzle.

30 The fire hose support may, of course, also be successfully used with railings of other than a circular cross-section, for example, a square or U-shaped cross-section.

35 The fire hose support may, of course, also be used with handrails that are non-parallel, or any other similar feature on which the grips may hold, as long as there is

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a pair of suitable seating points in between which the grips may be wedged so that the grips may not come loose by sliding to points with a greater separation.

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Claims

1. A fire hose support (1) for holding a fire hose nozzle, comprising an elongate member (7,9) with a pair of grips (4,5) adapted to receive a pair of parallel handrails (2,3) one in each grip, the length of the elongate member (7,9) being adjustable to adjust the distance between the grips (4,5), clamping means (22,30) (22,30) to clamp at least one of the grips (4) to a handrail (2), and mounting means (10) to releasably secure a fire hose nozzle to the support (1), in which the support (1) may be releasably secured to a pair of handrails (2,3) by first opening a grip (4) and adjusting the length of the elongate member (7,9) until both handrails (2,3) are received in the grips (4,5) and then clamping at least one of the grips (4) to engage both handrails (2,3) securely within the grips (4,5).
2. A fire hose support (1) as claimed in Claim 1, in which each grip (4,5) is a bracket with a concave shaped entrance extending substantially transverse to the elongate member (7,9).
3. A fire hose support (1) as claimed in Claim 2, in which the clamping means (22,30) comprises a flange (22) which opposes the entrance to one of the concave shaped brackets.
4. A fire hose support (1) as claimed in Claim 3, in which the flange (22) is slid able and securable with respect to the elongate member (7,9) so that a grip (4) may be clamped about a handrail (2).
5. A fire hose support (1) as claimed in any one of claims 2 to 4, in which the grips (4,5) are arranged with concave shaped entrances facing in the same direction.

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6. A fire hose support (1) as claimed in any preceding claim, in which one of the grips (4) is fixed on the elongate member (7,9) relative to the mounting means (10),  
5 and the other of the grips (5) is movable on the elongate member (7,9) relative to the mounting means (10), the clamping means (22,30) being arranged to clamp the grip (4) fixed on the elongate member (7,9) relative to the mounting means (10).
- 10 7. A fire hose support (1) as claimed in any preceding claim, in which the mounting means (10) is affixed to the end of the elongate member (7,9).
- 15 8. A fire hose support (1) as claimed in any preceding claim, in which the elongate member comprises a hollow sleeve (7) from inside of which an inner member (9) is relatively extensible and retractable to adjust the length of the elongate member (7,9).
- 20 9. A fire hose support (1) as claimed in Claim 8 in which the sleeve (7) has a slot (28) therethrough, the elongate member (7,9) having securing means (36,38) thereon to secure the length of the elongate member (7,9),  
25 the securing means (36,38) being arranged so that it may bear down through the slot (28) upon the inner member (9) to press the inner member (9) against the sleeve (7) and so secure the length of the elongate member (7,9).
- 30 10. A fire hose support (1) as claimed in Claim 9, in which the securing means (36,38) is slid able in unison with the clamping means (22,30) on the elongate member (7,9), the clamping means (22,30) being clamped when the securing means (36,38) secures the length of the elongate  
35 member (7,9).

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11. A fire hose support (1) as claimed in any one of claims 8 to 10, in which the inner member (9) is L-shaped and the sleeve (7) has an internal rectangular cross-section.

5

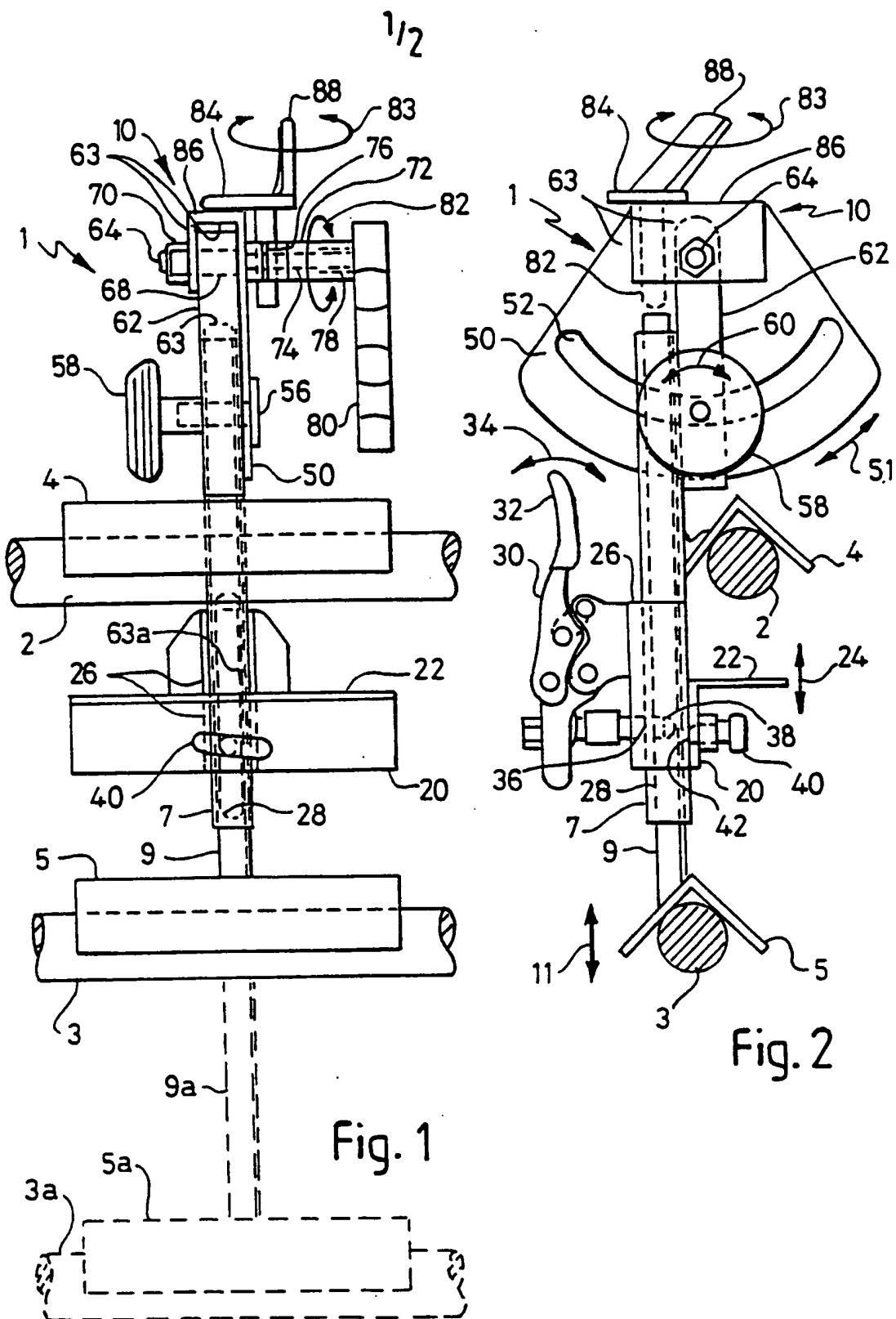
12. A fire hose support (1) as claimed in any preceding claim, comprising a fire hose adapter (100) which may be connected in-line between a fire hose and nozzle, in which the mounting means (10) comprises a tongue (88) which projects from the mounting means (10), and the adapter (100) has a channel (110) for receiving the tongue (88), the arrangement being such that the back pressure from water sprayed by the nozzle serves to keep the tongue (88) engaged within the channel (110).

10

13. A fire hose support (1) as claimed in Claim 12, in which the shape of the tongue (88) and channel (110) is such that the tongue (88) may only be inserted into the channel (110) in one direction (111).

15

20



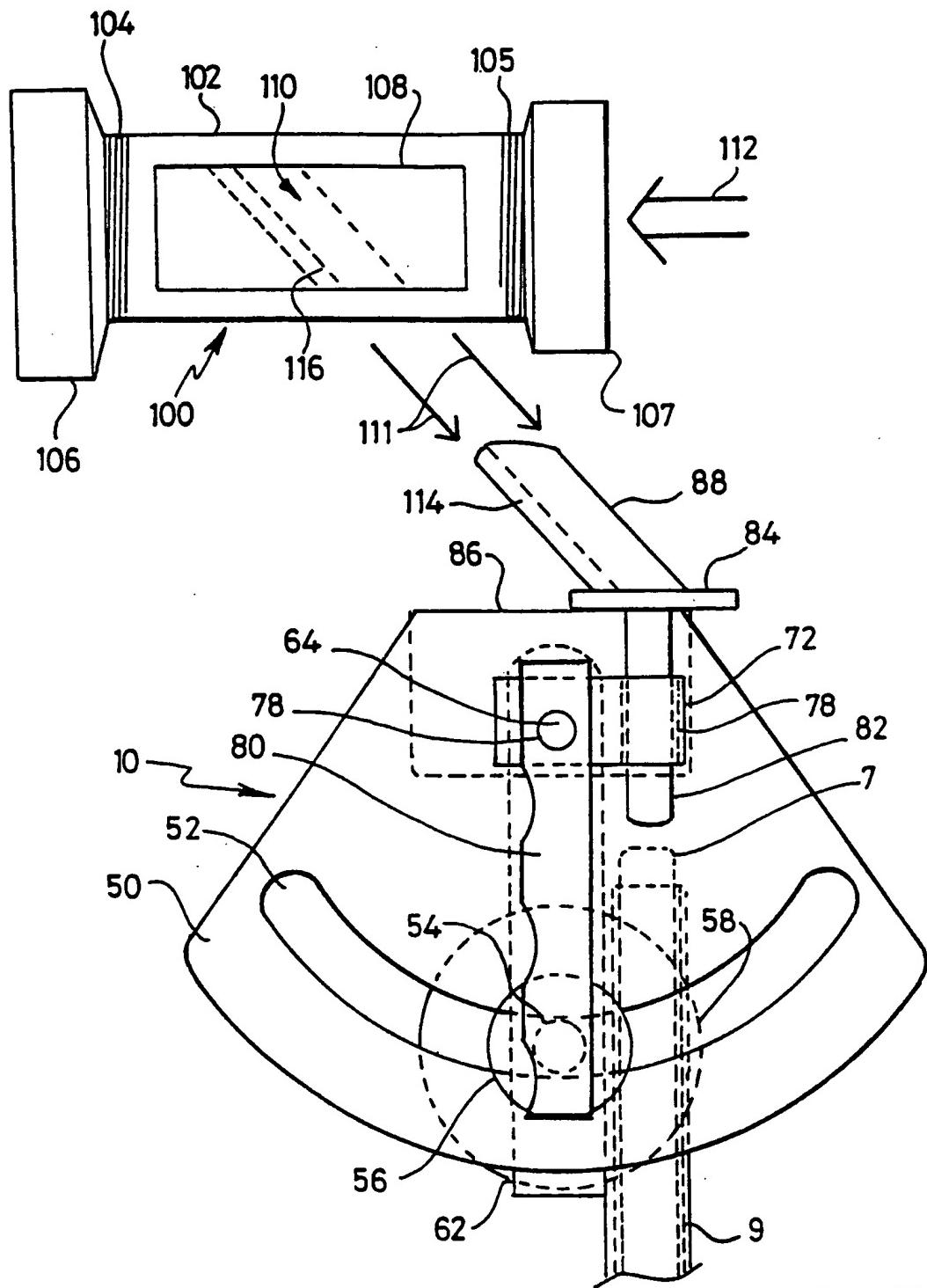
$2\frac{1}{2}$ 

Fig. 3

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 98/01566

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A62C33/04

According to International Patent Classification(IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 A62C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 732 106 A (FLEETLANDS SHIPYARD LTD) 22 June 1951 see page 1, line 89 - page 3, line 10; figures ----	1-13
A	US 3 603 539 A (CLEGG) 7 September 1971 see column 1, line 54 - column 2, line 37; figures ----	1-13
A	US 3 171 430 A (LOVELL) 2 March 1965 ----	
A	GB 330 473 A (BUNYAN) 3 July 1930 ----	
A	GB 593 769 A (KNIGHT) 20 November 1947 -----	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No

PCT/GB 98/01566

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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GB 593769	A	NONE	